Industrial symbiosis of biodiesel plants and agricultural biomass-based energy plants via co-gasification of crude glycerol waste streams with agricultural residues

The GlyCo Bio-Diesel Project

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ABSTRACT.

Glycerol is the principal by-product of biodiesel production via transesterification. Transesterification of vegetable oils and animal fats is the most common and widespread method of biodiesel production resulting in an ~10% crude glycerol. Such crude glycerol possesses very low value because of the contained impurities. As the demand and production of biodiesel grow exponentially, the utilization of the glycerol becomes an urgent topic for the biodiesel production units for environmental reasons and cost optimization. The crude glycerol could be considered for possible value-added utilizations and energy production. Besides energetic use, other uses for glycerol are production of chemicals in the aspect of biorefinery.

The present research work is focused on integrating CHP units within an industrial symbiosis scheme of biodiesel production plants and agricultural industries via gasification in a rural areas, obtaining industrial symbiosis in terms of potential synergies and environmental savings. A key task of the present study is to indicate the potential link between the agricultural industries, the bio-diesel companies and energy production. Co-gasifying crude glycerol with waste biomass demands identification of supply chain relations between companies using those by-products and of course analysis of implication of their individual characteristics on the mixing of feedstocks first and in process mechanisms as well in products yield, secondly. This study is being conducted under the frame of a research project (the GLY-CO Bio-Diesel project) running at AUTH, co-funded by EU and Greek Ministry of Education. In this work a small mobile co-gasification unit of crude glycerol blended with waste biomass for energy production is being assessed in terms of economic and environmental performance. The glycerol content in the fuel mix is less than 25% so as to keep the physicochemical and rheological characteristics of the feedstock in the pilot scale unit. The internal combustion engine has been specially modified to operate with the producer gas. Incorporating crude glycerol with local waste biomass in order to feed gasification – based small scale bioenergy units seems a promising technique in order to increase the sustainability reduce the environmental footprint of the whole industrial scheme.

Among other options of valorisation, co-gasification of crude glycerol with biomass appears to be of great perspective. This new approach seeks to improve the energy balance and resource efficiency of biodiesel plants and agricultural industries which symbiotically co-exist and to offer a solution for waste materials management. The integrated scheme demonstrates high conversion rate of waste materials in different forms for biofuels, heat and power. Finaly, symbiosis of biodiesel plants with biomass-based energy plants locally, is a key management strategy towards sustainability and environmental performance of the dual system.

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